

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently Amended) A method of inhibiting the corrosion of a metal surface contacted by an aqueous acid solution comprising:

(a) combining a corrosion inhibiting composition with the said aqueous acid solution, the said corrosion inhibiting composition comprising a the reaction product of an alpha,beta-unsaturated aldehyde or an alpha,beta-unsaturated ketone with a primary or secondary amine; and then

(b) contacting the said metal surface with the said aqueous acid solution containing the said corrosion inhibiting composition.

2. (Currently Amended) The method of claim 1 wherein the said alpha,beta-unsaturated aldehyde or ketone and the said primary or secondary amine are separately added to water used to form the said aqueous acid solution wherein the said alpha,beta-unsaturated aldehyde or ketone and the said primary or secondary amine react and form the said corrosion inhibiting reaction product therein.

3. (Currently Amended) The method of claim 1 wherein the said metal surface comprises at least one metal selected from the group consisting of: J55 steel, N-80 steel, 13Cr alloy, 25 Cr alloy, Incoloy 825 and 316L.

4. (Currently Amended) The method of claim 1 wherein:

the said alpha,beta-unsaturated aldehyde comprises at least one aldehyde selected from the group consisting of: crotonaldehyde, 2-hexenal, 2-heptenal, 2-octenal, 2-nonenal, 2-decenal, 2-undecenal, 2-dodecenal, 2,4-hexadienal, 2,4-heptadienal, 2,4-octadienal, 2,4-nonadienal, 2,4-decadienal, 2,4-undecadienal, 2,4-dodecadienal, 2,6-dodecadienal, citral, 1-formyl-[2-(2-methylvinyl)]-2-n-octylethylene, cinnamaldehyde, dicinnamaldehyde, p-hydroxycinnamaldehyde, p-methylcinnamaldehyde, p-ethylcinnamaldehyde, p-methoxycinnamaldehyde, p-dimethylaminocinnamaldehyde, p-diethylaminocinnamaldehyde, p-nitrocinnamaldehyde, o-nitrocinnamaldehyde, o-allyloxycinnamaldehyde, 4-(3-propenal)cinnamaldehyde, p-sodium sulfocinnamaldehyde, p-trimethylammoniumcinnamaldehyde sulfate, p-trimethylammoniumcinnamaldehyde o-methylsulfate, p-thiocyanocinnamaldehyde, p-(S-acetyl)thiocinnamaldehyde, p-(S-N,N-

dimethylcarbamoylthio)cinnamaldehyde, p-chlorocinnamaldehyde, 5-phenyl-2,4-pentadienal, 7-phenyl-2,4,6-heptatrienal, 5-(p-methoxyphenyl)-2,4-pentadienal, 2,3-diphenylacrolein, 3,3-diphenylacrolein, α -methylcinnamaldehyde, β -methylcinnamaldehyde, α -chlorocinnamaldehyde, α -bromocinnamaldehyde, α -butylcinnamaldehyde, α -amylcinnamaldehyde, α -hexylcinnamaldehyde, 2-(p-methylbenzylidene)decanal, α -bromo-p-cyanocinnamaldehyde, α -ethyl-p-methylcinnamaldehyde, p-methyl- α -pentylcinnamaldehyde, 3,4-dimethoxy- α -methylcinnamaldehyde, α -[(4-methylphenyl)methylene]benzeneacetaldehyde, α -(hydroxymethylene)-4-methylbenzylacetaldehyde, 4-chloro- α -(hydroxymethylene)benzeneacetaldehyde, α -nonylidenebenzeneacetaldehyde, 3,7-dimethyl-2,6-octadienal, and a β -hydroxy aldehyde[[s]] which dehydrates to form an α , β -unsaturated aldehyde[[s]] under acidic conditions; and

the said- α , β -unsaturated ketone comprises at least one ketone selected from the group consisting of: 4-phenyl-3-buten-2-one, 3-methyl-1-phenyl-2-buten-1-one, 4-phenyl-3-penten-2-one, 5-phenyl-4-penten-3-one, 6-phenyl-5-hexen-4-one, 7-phenyl-6-hepten-4-one-2-ol, 7-phenyl-6-hepten-4-one, 1,3-diphenyl-2-propen-1-one, 1,3-diphenyl-2-buten-1-one, dicinnamalacetone, 1,7-bis(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione, mesityl oxide, phorone, isophorone, 3-methyl-2-cyclohexen-1-one, 3,6-dimethyl-2,6-cycloheptadien-1-one, 5-methyl-4-hexen-3-one, and a β -hydroxy ketone[[s]] which dehydrates to form an α , β -unsaturated ketone[[s]] under acidic conditions.

5. (Currently Amended) The method of claim 1 wherein the said-primary or secondary amine comprises at least one amine selected from the group consisting of: ethanolamine, diethanolamine, a partially ethoxylated dehydroabietylamine, ethylamine, diethylamine, dehydroabietylamine, propylamine, dipropylamine, propanolamine, isopropanolamine, 2-propanol-1-amine, diisopropanolamine, butylamine, dibutylamine, tert-butylamine, pentylamine, dipentylamine, and tert-benzyl-tert-butylamine.

6. (Currently Amended) The method of claim 1 wherein the said-reaction product results from a the-reaction of the said-primary or secondary amine with the said- α , β -unsaturated aldehyde or alpha,beta-unsaturated ketone at a molar ratio of amine to aldehyde or ketone in the range of from about 0.1:1 to about 4:1.

7. (Currently Amended) The method of claim 1 wherein the said-corrosion inhibiting composition is combined with the said-aqueous acid solution in an amount in the range of from about 0.01% to about 5% by weight of the said-aqueous acid fluid.

8. (Currently Amended) The method of claim 1 wherein the said-corrosion inhibiting composition further comprises at least one corrosion inhibiting composition selected from the group consisting of one or more of an iodide source, a solvent, and or a surfactant.

9. (Currently Amended) The method of claim 1 wherein the said-aqueous solution comprises water and at least one acid selected from the group consisting of: hydrochloric acid, acetic acid, formic acid, and hydrofluoric acid.

10. (Currently Amended) The method of claim 1 wherein the said-aqueous acid solution comprises water and hydrochloric acid, the said-hydrochloric acid being present in an amount in the range of from about 5% to about 28% by weight of aqueous acid fluid.

11. (Currently Amended) The method of claim 1 which further comprises contacting the said-metal surface with the said-aqueous acid solution at temperatures up to about 300°F when the said-aqueous acid solution comprises hydrochloric acid at a concentration of about 15% by weight thereof.

12. (Currently Amended) The method of claim 1 which further comprises contacting the said-metal surfaces with the said-aqueous acid flush at temperatures up to about 275°F when the said-aqueous acid solution comprises hydrochloric acid at a concentration of about 28% by weight thereof.

13-24. (Canceled)

25. (Currently Amended) The method of claim 1 which further comprises contacting the said-metal surface with the said-aqueous acid solution at temperatures up to about 300°F when the said-aqueous acid solution comprises hydrochloric acid[[s]] at a concentration of from about 15% to about 28% by weight thereof.

26. (Currently Amended) The method of claim 1 wherein the said-corrosion inhibiting composition further comprises at least one component component selected from the group consisting of a quaternary ammonium compound; a corrosion inhibitor activator; an acetylenic alcohol; a Mannich condensation product formed by reacting an aldehyde, a carbonyl containing compound, and a nitrogen containing compound; an unsaturated carbonyl compound;

an unsaturated ether compound; formamide; formic acid; a formate; another source[[s]] of carbonyl; an iodide, a terpene, and an aromatic hydrocarbon.

27. (Currently Amended) The method of claim 26, the said quaternary ammonium compound having the formula:



wherein each R comprises at least one group selected from the group consisting of: is the same or a different group selected from a long chain alkyl groups; a cycloalkyl groups; an aryl group[[s]]; and a or-heterocyclic group[[s]], and wherein X is an anion.

28. (Currently Amended) The method of claim 26 wherein the said quaternary ammonium compound comprises at least one compound selected from the group consisting of: an N-alkylpyridinium halide, an N-cycloalkylpyridinium halide, an N-alkylarylpyridinium halide, an N-alkylquinolinium halide, N-cycloalkylquinolinium halide, and an N-alkylarylquinolinium halide.

29. (Currently Amended) The method of claim 26 wherein the said quaternary ammonium compound is present in the said corrosion inhibiting composition in an amount in the range of from about 1% to about 45% by weight of the corrosion inhibiting composition.

30. (Currently Amended) The method of claim 26 wherein the said corrosion inhibitor activator comprises at least one activator selected from the group consisting of: cuprous iodide, cuprous chloride, an antimony compound, an antimony oxide, an antimony halide, antimony tartrate, antimony citrate, an alkali metal salt of antimony tartrate, an alkalai metal salt of antimony citrate, an alkali metal salt of pyroantimonate, an antimony adduct of ethylene glycol; a bismuth compound, a bismuth oxide, a bismuth halide, bismuth tartrate, bismuth citrate, an alkali metal salt of bismuth tartrate, an alkali metal salt of bismuth citrate, iodine, an iodide compound, and formic acid.

31. (Currently Amended) The method of claim 26 wherein the said corrosion inhibitor activator is present in the said corrosion inhibition inhibit composition in an amount in the range of from about 0.1% to about 5.0% by weight of the composition.

32. (Currently Amended) A method comprising:

introducing an aqueous acid solution comprising a corrosion inhibiting composition into at least a portion of a subterranean formation, wherein the corrosion inhibiting

composition comprises the reaction product of an alpha,beta-unsaturated aldehyde or an alpha,beta-unsaturated ketone with a primary or secondary amine.